



## Welcome to Apogee Instruments

At Apogee Instruments, we are dedicated to advancing the science of environmental monitoring by offering a wide array of sensors, meters, and accessories tailored to meet the needs of researchers, agricultural professionals, and environmental scientists. Our products are engineered to provide accuracy and efficiency, empowering you to make data-driven decisions with confidence. Explore our catalog to discover how Apogee Instruments can elevate your work and help you achieve your scientific and operational goals.

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# Looking for more information and full product spec sheets?

- 1. Open your phone's camera app
- 2. Point camera at QR code
- 3. A box will pop up with a web link
- 4. Tap the link

You will instantly be taken to the most up-to-date spec sheet.





# RECALIBRATION SERVICES

Recalibration services from Apogee Instruments ensure that sensors and devices maintain peak accuracy and performance over time. **Recalibration is recommended every 2 years** to ensure reliability. These services restore original factory specifications, optimizing data reliability for your applications.

Apogee Instruments provides recalibration for the following products:

- Quantum Sensors
- Silicon-cell Pyranometers
- Thermopile Pyranometers
- Spectroradiometers
- Oxygen Sensors
- Infrared Radiometers

Apogee Instruments also provides recalibration services for **non-Apogee products**.

Scan the code to learn more about calibration services





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#### **Solar Radiation Sensors**

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#### **Weighing Precipitation Gauge**

The Cloudburst is a rugged, large capacity, all-weather weighing precipitation gauge that measures total precipitation from rain, snow, sleet, and hail.

Veighing Precipitation Gaug

#### **Features**

- High-accuracy, stable, stainless steel load cell
- Advanced Algorithm to filter the influences of evaporation, vibration, and temperature
- Fast and easy annual maintenance
- 8 inch (NWS) or 200cm<sup>2</sup> (WMO) inlet options
- Heated or unheated inlet

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• SDI-12 v 1.4 output

#### **Specification**

Scan code to see full specifications



Scan codes to access additional information.



#### **Fan-Aspirated Radiation Shield**

This rugged temperature shield ensures high quality data by protecting sensors from sun and weather. A lowpowered fan moves air, preventing errors from stagnant air. The PWM controlled fan allows for fan speed to be controlled remotely.

#### **Features**

- Multiple inserts for a wide range of sensors and probes
- IP55 rated fan
- PWM controlled fan speed
- Rugged thermoplastic design
- Monitorable fan RPM
- Low 80mA power draw a full speed
- 12 or 24 volt fan

#### **Specification**





#### Humidity Probe

The EE08-SS air temperature/relative humidity probe is manufactured by E+E Elektronik in Austria. The upgraded version sold by Apogee includes a stainless steel connector and a custom cable with a ninety degree connector that optimizes the fit of the probe inside the Apogee TS-100 and TS-200 series fan-aspirated radiation shields. The Apogee EE08-SS also includes a proprietary coating from E+E for the relative humidity sensing element that provides maximum long-term stability.

#### Specification

Scan code to see full specifications



Scan codes to access additional information.



#### **Temperature Sensors**

Wide measurement range of -60 C to 80 C

#### Models

• **ST-200** - Fine-wire thermistor measures delicate or small surfaces with a fast response time.

ST-200

ST-110

ST-300

ST-100

- **ST-110** Yellow-bead thermistor minimizes solar load and thermal conduction to accurately measure air temperature.
- ST-300 PRT PRT minimizes solar load and thermal mass
- **ST-100** Thermistor with a waterproof housing, designed for measuring soil and water temperature.

#### **Specification**





#### **Barometric Pressure Sensor**

The long-term non-stability of the SB-110 has been tested in indoor and natural outdoor conditions (with sensors mounted inside a datalogger enclosure). With the array of test sensors, drift was found to be less than 0.1 % per year. The SB-100 is now retired.

#### Features

- Budget friendly alternative
- Simple implementation
- Minimal accuracy drift

#### **Specification**

Scan code to see full specifications





Scan codes to access additional information.



#### **Heated Precipitation Detector**

The SG-050 Heated Precipitation Detector is designed to detect precipitation in many forms (rain, snow, sleet, and freezing rain) with pinpoint accuracy. Equipped with a built-in heating element, this device prevents ice build-up, ensuring uninterrupted performance in even the harshest conditions.

#### Features

- Accurate precipitation detection
- Built-in heating element
- Rugged design
- Easy installation
- SDI-12 protocol

#### **Specification**



#### **Radiation Frost Detector**

The Radiation Frost Detector sensor mimics a leaf, providing estimates of leaf temperatures to monitor radiation frost events. On calm, clear nights, leaf temperatures can drop well below air temperature. Radiation frost occurs when frost forms on a surface before the air temperature reaches freezing.

#### Features

- Sensor body features two holes for zip-tie mounting
- High accuracy thermistor of  $\pm$  0.1 C (0 to 70 C)
- 10/32 screw mount on body bottom
- SDI-12 or Analog output

#### Applications

- Field Crops
- Orchards
- Vineyards

#### **Specification**

Scan code to see full specifications

# SPEC SHEET

#### **Infrared Radiometer**

The Infrared Radiometers provide high-accuracy, noncontact surface temperature measurement. The rugged anodized aluminum body and fully-potted electronics are designed to preform in any weather while reducing thermal fluctuations.

#### Features

- Multiple FOV options
- Multiple outputs
  - Handheld meter
  - Unamplified voltage
  - Digital outputs
    - SDI-12
    - Modbus
    - RS-232
    - RS-485

#### **Specification**

Scan code to see full specifications







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#### **Oxygen Sensor**

The oxygen sensor can be used to measure gaseous oxygen in soils, enclosed environments and open environments. Output is proportional to oxygen concentration, which enables on-site calibration in open air conditions.

#### Features

- Heated sensor prevents moisture condensation
- Simple calibration
- 3 optional adapters for ground, in-line, 7/8in opening
- Multiple output options
  - Hand-held meter
  - Analog unamplified
  - Digital SDI-12

#### **Specification**

Scan code to see full specifications



Scan codes to access additional information.



#### **Guardian Greenhouse Monitor**

The Guardian is an all-in-one CEA (Controlled Environment Agriculture) monitor. The Guardian works as a stand-alone device or integrates into systems for grow rooms, greenhouses, and vertical farms. Available in PAR (SM-500) and ePAR (SM-600) options.

#### Features

- Fan-aspirated air temperature
- Instantaneous PAR or ePAR
- Daily light integral (DLI)\*
- Photoperiod\*
- Humidity
- Vapor pressure deficit and dewpoint
- CO<sub>2</sub> concentration
- Barometric pressure \*DLI and photoperiod measurements are only accessible via Bluetooth

#### **Specification** Scan code to see full specifications





#### **Silicon-Cell Pyranometer**

The Apogee Instruments silicon-cell pyranometer provides an accurate, budget-friendly option for measuring shortwave (solar) radiation. The silicon-cell pyranometer utilizes an accurate, cosine-corrected, and patented self-cleaning feature that allows the sensor to shed water and dirt. A heated option (SP-230) is available with a 0.2 W heater to minimize errors caused by dew, frost, or snow.

#### Features

- Heated or non-heated options
- Self-cleaning performance
- Multiple options
  - Analog (0-400mV, 0-2.5V, 4-20mA, 0-5V)
  - USB
  - Digital (SDI-12 or Modbus)
  - Handheld meter (Integrated or wired)

#### Specification

Scan code to see full specifications



#### **Thermopile Pyranometer**

The thermopile, blackbody detector produces significant spectral response improvements over silicon-cell pyranometers. The design keeps the price low and optimizes power requirement for the 0.2 W heater to minimize errors from dew, frost, and snow. A downward sensor is available for measuring shortwave reflectance and can be combined with an upward-looking sensor to measure albedo.

#### Features

- Heated or non-heated options
- Self-cleaning performance
- Upward facing option
- Downward facing option
- Multiple options
  - Analog (0-90mV)
  - Digital (Modbus)

#### Specification





#### Net Radiometer

Dual upward & downward pyranometers & pyrgeometers measure all four components of net radiation with a single digital output, conserving datalogger ports. It has comparable accuracy to other industry-leading competition in long-term field testing, but with a smaller housing and at a fraction of the price. Each sensor includes a 0.2 W heater to minimize errors from dew, frost, rain, and snow that can block the radiation path.

#### Features

- Small footprint
- Built-in heater
- Minimal current draw
- Self cleaning
- Multiple digital output options
  - SDI-12
  - Modbus

#### Specification

Scan code to see full specifications

# SPEC SHEET

#### **Albedometer**

Albedometers measure the broadband shortwave reflectivity of materials. They are used to monitor bifacial solar panels, understand heat retention in urban and architectural settings, and study climate and weather.

#### Features

- Small footprint
- Built-in heater
- Minimal current draw
- Self cleaning
- Digital output (Modbus)
  - Upward facing
  - Downward facing

#### Specification

Scan code to see full specifications



Scan codes to access additional information.





#### **Pyrgeometers**

A pyrgeometer is designed to measure incoming and outgoing longwave radiation. The sensor incorporates a filter, blackbody thermopile detector, a thermistor with a rugged, self-cleaning sensor housing design, and highquality cable. Sensor includes IP68 marine-grade stainlesssteel cable connector 30 cm from head to simplify sensor removal and replacement for maintenance and recalibration.

#### **Typical applications**

- Agricultural/Ecological
- Hydrological weather networks
- Renewable energy applications.

#### Features

- Small footprint
- Built-in heater
- Minimal current draw
- Self cleaning

**Specification** Scan code to see full specifications



#### UV-A Sensors

The Apogee Instruments UV-A sensor provides a cost effective method for measuring UV radiation from 305 to 390 nm.

#### **Typical applications**

- UV radiation measurement in outdoor environments
- Laboratory artificial light sources monitoring (e.g., germicidal lamps)
- Monitoring the filtering ability of materials

#### Features

- Self-cleaning housing
- Multiple output options
  - Digital
    - SDI-12, USB
  - Analog
    - 0-10 mV, 0-2.5V, 0-5V

#### **Specification**



## **Quantum PAR Sensors**

#### Quantum PAR Sensor

Photosynthetically Active Radiation (PAR) is the specific wavelengths that drive photosynthesis in plants. Traditionally the PAR range is noted as 400-700nm. Apogee offers two types of quantum sensors to measure the traditional PAR range: our high accuracy full-spectrum quantum and our less accurate, but more economical, original X quantum.

Recent research suggests the 700-750nm range may also contribute to plant growth. Because of this finding we created a sensor that also includes this extended PAR (ePAR)





All remote sensors offer a self-cleaning, cosine-corrected head that is fully-potted for a waterproof design that is designed to withstand the harshest of environments.



#### Underwater Corrected Meter

The Original X and the Full-spectrum sensor both have an underwater-calibrated meter option. These meters are designed to take PAR readings while submerged. An optional wand accessory provides easy access to hardto-reach areas.







#### **Original X**

The Original X quantum sensor is where it all began. This sensor was designed for and works best when measuring broadband radiation sources (sun, high-pressure sodium, metal halide, cool white fluorescent lamps).

#### Features

- Small footprint
- Minimal current draw
- Self cleaning
- Multiple output options
  - $\circ~$  SQ-515 0 to 5 V
  - SQ-520 USB
  - SQ-521 SDI-12
  - SQ-522 Modbus
  - MQ-500 Meter, separate sensor
  - MQ-510 Meter, underwater calibration
  - and more

#### Specification

Scan code to see full specifications

#### Original X response





#### Full-Spectrum

Full-spectrum sensors feature a more accurate sensor with a response curve that more closely matches a plants response curve. Apogee full-spectrum sensors are good for all light sources, ranging from sun to LEDs.

#### Features

- Small footprint
- Minimal current draw
- Self cleaning
- Multiple output options
  - SQ-512 0 to 2.5 V
  - SQ-520 USB
  - SQ-521 SDI-12
  - MQ-510 Meter, underwater calibration
  - SQ-522 Modbus
  - MQ-500 Meter, separate sensor
  - MQ-501 Meter, attached sensor
  - and more

#### Specification

Scan code to see full specifications



Full-spectrum response





#### **ePAR**

The Apogee ePAR sensor was created to measure the 400-750 nm extended PAR radiation range. Emerging research is showing this new range is photosynthetically active beyond the traditional 400-700 nm range. Much of the

transformative work to define the ePAR range was conducted by Dr. Zhen and Dr. Bugbee at Utah State University. Amplified and digital outputs are also available for the sensors (similar to the full-spectrum quantum sensor series).



#### **Typical Applications**

- ePAR intensity measurements over plant canopies in all growing environments
- Monitor and adjust grow lights
- Research plant morphogenic activity
- Photobiology studies

#### **Specification**

Scan code to see full specifications



#### **Quantum Light pollution**

Many plants are affected by interruptions in dark periods, even by extremely dim light. Apogee's quantum light pollution sensors are designed to detect photons from 340-1040 nm, which are below the typical sensitivity level of a normal quantum sensor.

Detecting stray photons that disrupt the night period is critical in preventing negative effects in plants, such as hermaphroditism and poor flowering.



applace

Made in US

- Typical ApplicationsPreventing dark period disruptions for sensitive plants like cannabis
- Incoming PFD measurement of combined UV-A, PAR, and far-red light
- Measuring light leaks and light pollution in greenhouses and growth chambers

#### **Specification**





#### **Red - Far-red Sensors**

This sensor is a research-grade, cost-effective, two-channel sensor for monitoring plant light environments. It can calculate the red to far-red ratio (red photon flux density / far-red photon flux density) and far-red fraction (far-red

photon flux density / sum of red and far-red photon flux densities). The FR ratio influences plant height, leaf expansion rates, and other photobiology and plant morphogenic responses.

#### **Typical Applications**

- Investigating the effect of spectral quality on phytochrome
- Monitoring plant light environments
- Analyzing plant morphogenic activity
- Studying photobiology
- Researching ecology

#### **Specification**

Scan code to see full specifications





#### **PAR - FAR Sensor**

The Apogee PAR-FAR sensor is a research-grade tool for measuring both the traditional PPFD photosynthetic photon flux and separately quantifying the photon flux of far-red photons (700-760 nm). The outputs include the traditional quantum flux, the far-red photon flux, and the

far-red fraction (far-red photon flux density / sum of PPFD and far-red photon flux density). This sensor reduces the need for more complex measurements from a spectroradiometer.

#### **PAR - FAR response**



- Typical ApplicationsMonitoring plant light environments
- Researching plant morphogenic activity
- Studying photobiology

#### **Specification**



## **DLI** Meters

Great for spot checking **AR** levels and tracking **DLI / photoperiod!** 





ePAR

**DLI-600** 

**DLI Meter** 

Apogee DLI meters are a rugged, simple-to-use device for spot checking PAR or ePAR levels while automatically recording the daily light integral and hours of light (photoperiod) for up to 99 days. The data can be viewed onscreen by toggling the button or by downloading via the included USB-C cable.

믹밍릭문



**DLI-400** 

**Original X** 

**Full-spectrum** 

#### **Three Models**

• DLI-400: Lowest-cost option is accurate for measuring 400-700 nm only in sunlight and under some broadband light sources

**DLI-500** 

- DLI-500: Full-spectrum is accurate for measuring 400-700 nm under all light sources, including LEDs
- DLI-600: ePAR is accurate for measuring the newly discovered extended PAR (ePAR) 400-750 nm range under all light sources, including LEDs



#### **Specification**







#### **InSight Handheld Spectroradiometer**

Self-powered and portable, the InSight instantly measures and displays the most important metrics for serious growers. View basic data on the unit's screen, see enhanced graphs on your PC or phone, and take sample or log

measurements over time.

#### InSight Software

Connect to your PC to view and analyze measurements with the Apogee InSight software or use the app (iOS



or Android). See ApogeeInstruments.com/downloads/.

• PPE

• iPPE

#### Measurement Modes

• PFD-R

- PPFD • PFD-UV • PFD-FR • CFI • FR F • FC
- ePPFD PFD-B
- PFD-G • YPFD
- Lux
- and more

#### **Specification**

• TPFD

Scan code to see full specifications



#### Lab Spectroradiometers

The various options include the spectroradiometer, a two meter fiber-optic cable, cosine-corrected detector, an AL-200 leveling plate, a USB cable, a USB drive with required drivers and software (compatible with all Windows operating systems), and a shoulder bag (functions as a carrying case and field measurement pack). A reflectance probe and reflectance standard are available as accessories.

#### **Features**

- Resolution as low as a 1 nm
- Multiple wavelength options
  - 350 to 1000 nm
  - 300 to 850 nm
  - 300 to 1000 nm

#### **Specification**







#### **NDVI**

Designed to continuously measure reflectance for calculating the normalized difference vegetation index (NDVI). NDVI provides an approximation of canopy chlorophyll content and leaf area and is used to monitor green-up in the spring and senescence in the fall.

#### **Features**

- Analog or Digital (SDI-12)
- Upward or downward facing
- Self-cleaning
- Rugged design



#### **Specification**

Scan code to see full specifications





#### **Features**

- Sample rate of < 3 seconds
- Over 35 species-specific settings
- Non-destructive measurements (take multiple reading of the same leaf)



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#### **Specification**



## µCache Bluetooth® Micro Logger

# Cache

#### <u>µCache Logger</u>

The Apogee µCache (microCache) is a rugged, batterypowered, low energy\*, Bluetooth® datalogging device that currently interfaces with most Apogee analog sensors.

When used as a standalone field-logging device, the unit contains enough memory to store nine months of oneminute data using the internal battery. Data can be viewed on your mobile device using our free ApogeeConnect App software for iOS and Android devices. ApogeeConnect features live meter mode, real-time graphing, and the ability to wirelessly transmit datasets to your computer. \*µCache is only low energy with longer sampling intervals

#### $\mu$ Cache Bundles

Bundles include an analog sensor with a 30 cm or 2 m cable, a µCache Bluetooth Micro Logger, a protective neoprene case, an extra µCache battery, and an Apogee PVC sensor platform. See website for available bundles.



#### **Features**

- Stores and transmits real-time data to iOS and Android devices
- View and download data with ApogeeConnect app
- Programmable sampling and logging intervals
- Live meter and datalogger modes
- Large capacity with nine months of data (1 minute interval)
- IP67 rated for harsh environments
- Works with Apogee quantum sensors, pyranometers, and infrared radiometers. See our website for a current list of compatible sensors.

#### **Specification**







#### **Accessories**

Apogee Instruments offers a range of accessories designed to enhance the functionality and usability of our sensors. These include sensor mounting brackets, leveling devices, cables, and data loggers for seamless installation and operation. Our accessories are tailored to optimize sensor performance across applications such as agriculture, environmental monitoring, and research.



A. AX-605-SS: 5 meter extension cable B. AM-501: Rod-based mounting fixture C. AG-002: Cloudburst pole mount D. AM-330 Expandable sensor wand E. AM-140: NDVI handheld adapter F. AL-120: Sensor leveling plate G. AC-422: Modbus converter H. AY-002: NDVI signal splitter



#### **UPCOMING TRADE SHOWS:**

apgee Unru INSTRUMENTS AMS New Orleans, LA

Indoor Ag-Con Las Vegas, NV

> NCERA Monterrey, Mexico

> > **EGU** Vienna, Austria

Aquashella Dallas, TX

Greentech Amsterdam Amsterdam, Netherlands

> AgriVoltaics Freiburg, Germany

> > Cultivate Columbus, OH

ASHS New Orleans, LA

MetTech Europe Vienna, Austria

> ASA Salt Lake City, UT

MJBizCon Las Vegas, NV

AGU New Orleans, LA

Jan. 12-16 Mar. 11-12 April 5-9 April 28-May 1 May 18-19 June 10-12 **July 1-3** July 12-15 July 28-Aug. 1 Oct. 14-16 Nov. 9-12 **Dec. 2-5** Dec. 15-19

Meet the team

- Test Apogee products
- Get Apogee swag
- Exclusive first look at new products

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### INSTRUMENTS

+1-435-792-4700 721 W. 1800 N. Logan, UT. 84321, USA ApogeeInstruments.com